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Thu-Af-Or21-04: Development of Superconducting-Magnetic-Energy-Storage (SMES) for Aerospace Applications

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Electrical energy storage devices are critical components of electric power systems of every aerospace vehicle. They are needed for many functions, such as an electrical accumulator unit (EAU) to handle transient loads both on/off the buses, for emergency power during system failure, to provide high-power for pulsed loads, and as an energy source for electric-vehicle (EV) propulsion. Superconducting-magnetic-energy-storage (SMES) devices offer unique features for aerospace applications including the highest power densities known achievable > 100 kW/kg for both charge and discharge, 100% storage efficiencies for unlimited times, and virtually no degradation for up to 108 charge/discharge cycles for some designs.
This paper will describe about the functions of SMES for aerospace application, and provide a recent update on the development and performance of SMES and large magnets being developed and built. The development of supporting technologies needed to integrate SMES into aerospace vehicles will be presented. In-house computation of the design of SMES devices optimized for mass-specific energy densities will be shown, and compared with devices presently existing or being developed. The energy density of SMES was traditionally < 10 Wh/kg, however recent computational investigations indicate the energy densities could reach > 100 Wh/kg and be competitive with Li-batteries.

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